

Shelter

*The north wind doth blow, and we shall have snow,
And what will the robin do then, poor thing?
He'll sit in a barn, to keep himself warm
And hide his head under his wing.*

Traditional Nursery Rhyme, Author Unknown

Some people are simply driven to have animals in their lives—and for those of you who fall into this category, know this: You are in good company; about 85% of your friends, neighbors and relatives squarely fall into the same camp.

For some people, time and space limit their direct contact with critters, but they foster a relationship with wildlife, feeding the birds, talking to squirrels, and simply enjoying the natural life in their backyard. For others, family companions, like dogs, cats, and birds, or something a little more exotic—ferrets, pot-bellied pigs, or iguanas, for instance—enrich their world. Then there's the group that Ken and I fall into—the group that keeps farmyard animals.

This relationship, between people and animals, began back when people still considered a skin and pole structure to be the lap of luxury, and their animals sought shelter anywhere they could. In good times, the animals found relief from nature's fury on the lee side of hills, or in forests, or arroyos. In bad times they found no break from rain or snow, sun or flies.

Now, by and large, we find shelter in airtight, climate-controlled boxes, comfortable in shorts and tees in January, or our flannel shirts in July. Do our animals need the same climate-controlled environment that we call home? *No, they don't.*

So, before you get ready to build your dream barn, ask yourself if you actually need a building! Seriously, the cost of building a barn or stable is very high, and you may not need it at all. As our ancestors knew, livestock doesn't necessarily need a permanent building; if your animals will be having their babies on pasture, during the spring flush (the early part of the grass growing season), and if they have shelter from wind and sun, they can get along pretty well without buildings, or they can use portable or temporary structures. Windbreaks and shade structures are easier to build, and cost far less than a barn. We have raised all kinds of animals for decades, and have done without a "barn" more often than not.

You will need some animal housing if the babies will be born in the winter, and small animals (chickens, turkeys, ducks, rabbits) must have some kind of building to keep them safe, especially at night, from marauding neighborhood dogs, or scavenging coyotes, but these can be a small and inexpensive shed.

Factory Farms and the Environment

In 1950, there were 2.1 million farmers selling hogs in the United States. Fifty years later, in 2000, there were fewer than 99,000. Yet, while the number of hog farmers has decreased, the number of hogs produced has remained roughly the same. The difference is that the average number of hogs per farm has increased dramatically, from 31 per farm to 1,100.

Today, there are 105 farms producing more than 50,000 hogs each, accounting for 40% of the U.S. hog inventory. And four corporations account for 20% of total U.S. hog production.

A single hog, raised industrially, produces 1.9 tons of manure a year. A typical 5,000-hog factory produces 9,500 tons of manure a year or nearly 26 tons a day—about the same amount generated by a small town. But a town would have a sewage treatment plant, and traditional, small-scale hog farms integrate manure into the farming system by composting it and using it to fertilize fields, without nutrient runoff. Hog factories, on the other hand, store these massive amounts of waste in open lagoons or, increasingly, in concrete cisterns under the hog factory barns.

When this manure runs off the land or leaks into waterways, fish kills can occur. Local well water can become contaminated, and massive swarms of flies can emerge. What's more, odors from lagoons can make being outside unbearable for people who live miles around a hog factory.

Iowa, which produces 15 million hogs a year (more than any other state), constitutes only 5% of the Mississippi River's watershed, but contributes 25% of the nutrient pollution to the waterway. Nutrient pollution has created a 7,000-square-mile (and growing) dead zone in the Gulf of Mexico.

The cumulative impact of many smaller spills can be equally harmful. In 1999 alone, the largest pig farm in the U.S. was responsible for 25 liquefied manure spills and discharges in Missouri. More than 224,000 gallons of manure and wastewater were discharged during these spills. With permission: The Humane Society of the United States, copyright 2003

Admittedly, buildings often make *our lives* easier and more convenient: Taking care of a sick animal in January is much less onerous in a barn than out on pasture in a blizzard, or having an organized building with storage for feed, tack, tools, and equipment, along with a couple of pens for animals that need special attention, is wonderful. But not having a barn doesn't mean you can't successfully and happily raise some animals.

Animal welfare

As agriculture has moved to an industrial, or factory-farm system, with vertical integration (one company controlling the animal from birth to the consumer's plate) and confinement as its cornerstone, animals have been treated like machines. Two-hundred-thousand hens may occupy a single building at an egg farm, each allotted less space than the page you are reading, and hogs are raised in a building the size of a football field, with thousands of animals crammed inside.

The impacts of factory farms include not only cruelty to the animals, but also environmental problems that reach far from their source, and social problems for rural communities that lose their base of small, independent farmers. To deal with health problems associated with large confinement operations, factory farms use routine antibiotics, which are believed to contribute to the reduced effectiveness of many antibiotics in treating human illness.

These issues have helped spur strong support for animal welfare among consumers, and small farmers have an advantage, in that they can market humane animal treatment as one of their marketable products!

Stress and fear

When animals are stressed or scared, they demonstrate both physiological and behavioral changes, ranging from increased respiration to aberrant behaviors, like cage biting or fighting. Animals that are healthy and happy on the other hand, tend to exhibit few of these changes. Dr. Temple Grandin, a renowned Animal Scientist at Colorado State University, says that animal cruelty falls into two categories:

Category 1 Abuse & Neglect:

“These are abuses that good livestock producers would not tolerate. They are animal cruelty abuses such as dragging downed crippled cattle, rough handling, throwing baby dairy calves, beating an animal, starving an animal, failing to provide shelter, or shackling and hoisting an animal prior to ritual slaughter. Almost all problems that occur during handling, transport and slaughter of livestock are Category #1 abuses. I estimate that over 75% of all livestock producers, transporters and slaughter plants do a good job of preventing these abuses. However, 10% allow Category #1 abuses to occur frequently and another 10% occasionally have problems with animal abuse. This is an area where the industry needs to clean up its house and take action against the bad operators.”

The Five Freedoms

Animal welfare advocates support the five freedoms for domestic animals:

1. Freedom from malnutrition,
2. Freedom from discomfort,
3. Freedom from disease,
4. Freedom from fear or distress,
and
5. Freedom to express normal
behavior.

Category #2 Boredom and Restrictive Environments:

“Whereas the animal welfare issues in Category #1 concern obvious animal abuses and cruelty, the issues in Category #2 do not involve pain. Category #2 welfare issues are animal boredom and abnormal behaviours, which may occur in barren environments that do not provide adequate stimulation. Examples would be gestation stalls for sows, veal calf housing in individual stalls, and chickens in cages.”

Animal senses

Understanding how animals respond to their world, through their senses, will help you to understand what causes stress, and to reduce stress in the design of animal housing. Livestock species are prey animals, and as such, they have developed senses that help them find food and shelter, navigate around their range, and most importantly, avoid predators.

Most farm animals have a wider field of vision than humans, which allows them to see predators moving in on them from almost any direction. This is because they have

relatively large eyes for the size of their heads, which are located on the sides of their face. (The one exception is the pig, which, as an omnivore, has eyes very similar to our own.) In spite of the wide field of vision, most animals do have a blind spot behind them.

Visual acuity is the most relied upon sense for prey animals, followed closely by hearing. New items in a pen or barn—say a jacket hanging over a rail, or a shovel lying in the middle of the walkway—can cause a fear reaction. Loud, sudden sounds, and high-pitched sounds also cause a fear reaction in most animals.

Like people, animals have a natural curiosity about the world around them, and they tend to use their senses of smell and touch to investigate. Through touch and smell they identify their offspring and herd mates, as well as checking out something new, like a tractor parked in the pasture, or a new type of feed.

Few animals won't adapt quickly to new things, if given the chance to investigate them, but they need time for that investigation. Whenever you introduce them to something—or someplace—new, let them take their time. An animal with a calm disposition, that has never suffered from extreme human-caused fear, may seem to immediately accept the new and the novel within their world; other's that are a little more high strung, or that have had bad experiences in the past, may take quite some time to settle down and accept what you are introducing them too. Be patient, or risk injury to you or your animals.

Safety

The first consideration in animal housing is safety for both you and your animals. Tripping and falling are the most common causes of accidents. Floors should be of a non-slip surface. For example, if animals will be expected to walk on concrete floors, the concrete must be grooved for traction (1/2" deep grooves work well), coated with a non-slip coating, or covered with rubber mats or deep bedding.

Space should be provided for storing tools and equipment out of walkways, and storage areas should be constructed so animals cannot access them (including areas where spare feed is stored, as more than one animal has died from overeating). Walkways should be at least 10 FT wide for horses and cattle, and 7 Ft wide for sheep, goats, pigs, and llamas.

Electrical installations must be inaccessible to animals, and systems must be designed for the humid and dusty environmental conditions that occur in barns and stables. Lighting should be adequate for you and the animals to move with clear vision, meaning light fixtures should be installed so that lighting is even and diffuse; the fixtures should have protective covers that prevent dust and moisture from corroding wires and causing shorts, and the cover should be resistant to breaking. The electrical system should be well grounded, and should have adequate load capabilities for the tools and equipment that will be used in it. Use ground fault interrupters (GFI) plug receptacles. Appliances, like radios or coffee pots, should be unplugged when not in use.

Fire is an important consideration in animal housing. Barns are often full of highly combustible materials, like hay and straw. A hot ash, an electrical short, or a hot engine can set off a conflagration in no time. All barns should have adequate fire

extinguishers placed near each door. Consider installing a heat and smoke sensor, with an alarm mounted outside the barn, and an alarm in the house. These new sensors pick up a sudden increase in temperature, even if smoke is not yet detectable. Barns can also be designed with sprinkler systems.

All construction should be done so that there are no protruding nails or sharp metal edges exposed. Gates should have secure latches, yet they should be easy for humans to open with one hand, or when wearing heavy gloves. Paints and wood preservatives need to be carefully selected, as many of these products can give off toxic fumes, or may be toxic if ingested (and bored animals often chew on exposed wood).

There are a number of other points to consider when designing animal housing that contribute to the general health and happiness of your animals. I firmly believe all animals should have access to pasture or outdoor pens, which is the easiest way to avoid the boredom of category 2 abuse, but those that will spend a significant amount of time in a building need sufficient space, clean air, which means good ventilation, clean water, comfortable bedding or flooring; and freedom from excessive noise. Handling facilities, to improve moving animals into and out of buildings, and for quarantining new animals are an important component of your overall building plan.

Table of space requirements

Finishing Cattle 800 # to 1200 #	NA	35 FT2	7 FT	2 FT
Calves 400 # to 800 #	NA	25 FT2	7 FT	1.5 FT
Calves less than 400 #	NA	15 FT2	6 FT	0.75 FT
Mare	144vFT2	100 FT2	10 FT	3 FT
Stallion	NA	196 FT2	10 FT	6 FT
Foal	NA	100 FT2	7 FT	2 FT
Ewe or Doe	25 FT2	16 FT2	6 FT	1.5 FT
Ram or Buck	NA	30 FT2	6 FT	1.5 FT
Lamb or Kid pre-wean	NA	2 FT2	6 FT	2 IN
Lamb or Kid weaned	NA	10 FT2	6 FT	1 FT
Sow	64 FT2	48 FT2	7 FT	2 FT
Gilt	NA	40 FT2	7 FT	1 FT
Boar	NA	60 FT2	7 FT	3 FT
Finishing pigs 150 # to 220 #	NA	16 FT2	6 FT	
	<i>Nest Boxes</i>	<i>Floor Space</i>	<i>Perch space</i>	
		<i>per Bird</i>	<i>per bird</i>	
Hens--Layers	1.5 FT2	1.5 FT2	0.75 Ft	
Broilers	NA	1.5 FT2	0.75 Ft	
Bantam Chickens	1 FT2	1 FT2	0.5 Ft	
Turkey Heavy Toms	NA	5 FT2	NA	
Turkey Toms	NA	4 FT2	NA	
Turkey Hens	3 FT2	3 FT2	NA	
Turkey Broilers	NA	2 FT2	NA	
Pheasents	3 FT2	5 FT2	NA	
Ducks	2 FT2	3 FT2	NA	
Geese	3 FT2	6 FT2	NA	

Breathing easy

Nothing can kill an animal quicker than being locked up in a poorly ventilated building. Animals that are confined to a barn give off moisture and gasses, like carbon dioxide and methane, as part of their respiratory and digestive functions. Manure and urine add ammonia, hydrogen sulfide, and carbon monoxide to the air. Dust from bedding and feed adds particulates to the air that aggravate respiratory passages, and may host allergen-producing molds. And, pathogenic bacteria and viruses can survive in moisture-laden air for long periods of time.

Ventilation systems can be either natural or mechanical. They are designed to remove excess moisture and contaminants, prevent drafts, and maintain comfortable temperatures for the age and class of animal spending time in the barn. Systems should be designed with both inlets for bringing fresh air in, and outlets for removing stale air. The best ventilation occurs when there is a good balance of these two types of vents.

Maintaining a balance

In the course of normal breathing, animals give off moisture as they exhale. As temperatures increase, they begin to pant, thereby increasing the moisture that they give off. A mature dairy cow, for example, gives off about 0.85 pounds of water per hour at 30F, but when the temperature is 80, she more than doubles that, at 1.98 pounds of water per hour. In an enclosed building, this moisture is captured in the air, creating high humidity. As air temperature increases, the air can hold more moisture. When both temperature and humidity are high, the animal will suffer from heat stress, which at a minimum reduces production (meat, milk, fiber, eggs), but which can also result in death.

The ideal humidity level in a barn is in the 40 to 60% range. This range helps keep dust down, at the same time as it minimizes airborne pathogens and condensation. Condensation forms on surfaces where warm, moist air comes in contact with a cool surface, like the wall or ceiling, and it can cause buildings to rot.

Ventilation air entering a building is generally cooler than inside air (even on a hot day), so it removes moisture and cools the inside air. During cold weather, airflow just needs to be enough to remove the humidity, but in hot weather it needs to reduce temperature as well. Ventilation systems need to be designed to find a balance between temperature and humidity throughout all seasonal changes—hot weather, mild weather, and cold weather. Two story barns require extra attention to provide adequate ventilation, and include flues or chimneys to move stale air from the lower level up to a ridge vent or cupola.

Heating

Although mature animals don't generally require a heated barn, baby animals may if they're born in winter. Supplemental heat may also be called for in milk rooms and parlors, holding areas for sick animals, or in areas that you will be spending time in—like an office, tack room, or shop. Without the addition of supplemental heat, three things affect indoor temperature: The ambient air temperature outdoors, body heat given off by the animals, and heat generated from equipment, like lights or compressors.

In a small, or multi-purpose barn, radiant heaters often supply supplemental heat for baby animals. These can be infrared heat lamps, or gas heaters, placed over the pen or enclosure. These must be hung adequately high above the pen to not cause a fire hazard or threat to the animals. No more than six 250W heat lamps should be used on a 15 or 20 amp breaker. Although piglets and chicks (poults, ducklings...) require supplemental heat for an extended time, lambs, kids, calves and foals only need it immediately after birth, if at all; once they are dry, supplemental heat can be turned off.

For specialty barns that will be regularly used for babies, like a pig-farrowing barn and nursery, heat is often supplied through radiant floor systems. These can be constructed in the floor using hot-water piping, hot-air piping, or electrical resistance cables. Another approach is to use fiberglass mats with coils in them that are placed on the existing floor.

Area heating, for example to heat a milk room, is usually supplied by space heaters. Vented gas heaters are the best choice for routine use, because they are economical and safe. Un-vented gas heaters shouldn't be used, because they add to the problems with gasses like carbon monoxide, and electrical space heaters are expensive if you run them with any regularity.

Insulation

The idea behind insulation is that it reduces heat transfer by conductance and convection, thereby keeping buildings warmer in the winter, and cooler in the summer. Even open buildings, like a three-sided loafing shed, can benefit from having a layer of insulation added to the ceiling: It will reduce heating in summer, and condensation in winter.

In insulated buildings, use a vapor barrier on the warm side of insulated walls. Six-mil polyethylene film is usually the best choice. Taping joints, nail holes, gaps around electrical fixtures, and other holes in the barrier improves performance.

Bedding

Bedding (litter) is used to absorb moisture from urine and manure, and to provide comfortable areas for animals to lie. Bedding needs to either be cleaned thoroughly on a daily basis, or use a technique known as deep bedding.

In the deep-bedding system, a 6" layer of bedding is placed on the ground. With small animals, like birds or rabbits, manure and wet spots are cleaned off the top surface once a week; with large animals it's cleaned off every day or two. After taking the worst piles, add new bedding on top so that the area is again dry (an inch or two is generally plenty).

The bedding pack builds up, so once every year or two, you need to clean it all out and start fresh, but in the meantime, you will haul fairly small loads. When you do clean out the pack, you will have partially composted material. Pile it into a compost pile, and a year later you will have the finest soil amendment in the universe! Cleaning it out will be easiest if your building is designed so that you can get into it with a tractor equipped with a loader bucket, but it can also be done by hand, a little at a time.

Deep bedding not only yields great compost for the garden, it also provides animals with a clean, dry, comfortable area. It is soft and warm, and well cushioned. There are less ammonia fumes with deep bedding than with daily cleaning, because the pack absorbs the urine.

Pest control

I hate pests, like flies and rats around the barn, and I'm not too fond of mice. Unfortunately, these pests generally love barns.

One of the most effective methods to minimize flies in the barn is simple and cheap: install screens on all openings. Keeping doors closed, and windows shaded (used burlap feed sacks make fine window shades), also helps reduce fly pressure. Sawdust and wood shavings (from pine) are better bedding materials than straw, because they contain a natural chemical compound that bugs don't like. Traps, like sticky tapes or jars with attractant, are effective for the odd flies that get into a screened building.

Rats and mice generally come for stored feed. Storing grain and other feed away from the barn helps, but then you are dealing with moving it all the time. Providing tightly closing doors and windows will help keep them out, but keeping food in varmint proof containers is a key to success for barn stored grain. On a small operation, heavy-plastic trashcans with tight fitting lids work well for storing grain.